greatest monthly amount, 8.81, occurred at Ruston, and the least, 0.26, at Houma.—*W. T. Blythe.*

Maryland and Delaware.—The mean temperature was 41.4°, or 0.3° below normal; the highest was 77°, at Hancock, Md., on the 12th, and the lowest, 1°, at Sunnyside, Md., on the 7th. The average precipitation was 4.92, or 1.50 above normal; the greatest monthly amount, 7.42, occurred at Sunnyside, Md., and the least, 2.44, at Boonsboro, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 23.6°, or 4.9° below normal; the highest was 68°, at Mount Clemens on the 11th, and the lowest, 21° below zero, at Sidnaw on the 11th, at Wetmore on the 16th, and at Lathrop on the 17th. The average precipitation was 3.29, or 1.24 above normal; the greatest monthly amount, 6.72, occurred at Berrien Springs, and the least, 1.08, at Calumet. The average snowfall, 22.5 inches, is 9.8 inches greater than the snowfall for any previous March of which there is record.—*C. F. Schneider.*

Minnesota.—The mean temperature was 14.7°, or about 9.0° below normal; the highest was 52°, at Moorhead on the 8th, and the lowest, 38° below zero, at Pokegama on the 1st. The average precipitation was 1.58, or about normal; the greatest monthly amount, 6.51, occurred at New Ulm, and the least, 0.30, at Morris.—*T. S. Outram.*

Mississippi.—The mean temperature was 56.6°, or about normal; the highest was 90°, at Yazoo City on the 27th, and the lowest, 9°, at Booneville on the 6th and at Okolona on the 8th. The average precipitation was 5.78, or 0.37 below normal; the greatest monthly amount, 11.67, occurred at Biloxi, and the least, 2.05, at Hattiesburg.—*H. E. Wilkinson.*

Missouri.—The mean temperature was 37.3°, or 5.0° below normal; the highest was 78°, at Wylie on the 9th, and the lowest, 8° below zero, at McCune Station on the 7th. The average precipitation was 2.93, or 0.56 below normal; the greatest monthly amount, 7.03, occurred at Sublett, and the least, 1.09, at Mineralsprings.—*A. E. Hackett.*

Montana.—The mean temperature was 21.9°, or 3.7° below normal; the highest was 68°, at Kalispel on the 26th, and the lowest, 31° below zero, at Glasgow on the 22d. The average precipitation was 1.14, or 0.18 above normal; the greatest monthly amount, 3.00, occurred at Fort Yellowstone National Park, and the least, 0.25, at Kalispel—*E. J. Glass.*

Nebraska.—The mean temperature was 26.8°, or about 7.0° below normal; the highest was 82°, at Alma and Beaver City on the 8th, and the lowest, 15° below zero, at Kimball on the 26th. The average precipitation was 0.92, or 0.23 below normal; the greatest monthly amount, 3.40, occurred at Bassett and Rulo, and the least, trace, at Callaway.—*G. A. Loveland.*

Nevada.—The mean temperature was 38.6°, or about normal; the highest was 79°, at Panaca on the 24th, and the lowest, 4°, at Empire Ranch on the 13th. The average precipitation was 1.83, or 0.76 above normal; the greatest monthly amount, 8.51, occurred at Lewers Ranch, while none fell at Las Vegas.—*J. H. Smith.*

New England.—The mean temperature was 29.9°, or 1.1° below normal; the highest was 65°, at Boston, Mass., on the 12th, and the lowest, 19° below zero, at Berlin Mills, N. H., on the 18th. The average precipitation was 6.43, or 2.91 above normal; the greatest monthly amount, 9.67, occurred at Kingston, R. I., and the least, 3.45, at Cornwall, Vt.—*J. W. Smith.*

New Jersey.—The mean temperature was 38.6°, or 1.4° above normal; the highest was 73°, at Beverly, Bridgeton, and Port Norris on the 12th, and the lowest, 13°, at Chester on the 21st. The average precipitation was 6.54, or 2.57 above normal; the greatest monthly amount, 9.58, occurred at Lebanon, and the least, 3.45, at Cape May City.—*E. W. McGann.*

New Mexico.—The mean temperature was 45.2°, or 0.6° above normal; the highest was 92°, at Eddy on the 22d, 23d, and 24th, and the lowest, 10° below zero, at Fort Union on the 27th. The average precipitation was 0.50, or 0.07 below normal; the greatest monthly amount, 1.62, occurred at Monero, and the least, trace, at Rincon.—*R. M. Hardinge.*

New York.—The mean temperature was 30.1°, or 0.3° below normal; the highest was 72°, at Nunda on the 12th, and the lowest, 12° below zero, at North Lake on the 17th. The average precipitation was 4.65, or 1.31 above normal; the greatest monthly amount, 11.24, occurred at Kings Station, and the least, 1.03, at Hemlock Lake.—*R. G. Allen.*

North Carolina.—The mean temperature was 50.0°, or 1.5° above normal; the highest was 81°, at Sloan on the 4th, and the lowest, 7° below zero, at Highlands on the 7th. The average precipitation was 7.04, or 2.40 above normal; the greatest monthly amount, 14.24, occurred at Highlands, and the least, 1.01, at Wilmington.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 7.8°, or 12.5° below normal; the highest was 72°, at Berthold Agency on the 8th, and the lowest, 30° below zero, at Milton and Woodbridge on the 6th. The average precipitation was 1.06, or 0.10 above normal; the greatest monthly amount, 2.99, occurred at Fullerton, and the least, 0.11, at Woodbridge.—*B. H. Bronson.*

Ohio.—The mean temperature was 36.9°, or 1.6° below normal; the highest was 76°, at Portsmouth on the 11th, and the lowest, zero, at Bethany on the 7th. The average precipitation was 4.66, or 1.21 above normal; the greatest monthly amount, 7.70, occurred at Hanging Rock, and the least, 2.31, at Bladensburg.—*J. Warren Smith.*

Oregon.—The mean temperature was 42.9°, or 1.6° below normal; the highest was 75°, at Vernonia on the 5th, and the lowest, 6°, at Joseph on the 14th. The average precipitation was 4.03, or 0.25 below normal; the greatest monthly amount, 13.28, occurred at Government Camp, and the least, 0.23, at Arlington.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 36.3°, or 0.6° above normal; the highest was 75°, at Confluence on the 11th and at Aqueduct on the 12th, and the lowest, 3°, at Smethport on the 21st. The average precipitation was 4.87, or 1.44 above normal; the greatest monthly amount, 10.30, occurred at Hawthorn, and the least, 1.91, at Shinglehouse.—*T. F. Townsend.*

Texas.—The mean temperature for the State, determined by comparison of 46 stations distributed throughout the State, was 1.4° above the normal; there was a slight deficiency over the northwestern portion of the State, while there was a general excess or nearly normal conditions elsewhere; the highest was 107°, at Llano on the 25th, and the lowest, 1° below zero, at Tulia on the 28th. The average precipitation, determined by comparison of 52 stations distributed throughout the State, was 1.69 below the normal; there was a general deficiency, ranging from 1.00 to 4.78 over north, central, southwest, and east Texas and the coast district, with the greatest in the vicinity of Sulphur Springs; there was only a slight deficiency over west Texas and the panhandle, where the normal rainfall for the month does not amount to as much as 1.00; the greatest monthly amount, 2.35, occurred at Huntsville, while none fell at a number of stations.—*I. M. Cline.*

Utah.—The mean temperature was 38.5°; the highest was 84°, at St. George on the 7th, and the lowest, 3° below zero, at Woodruff on the 14th. The average precipitation was 2.46; the greatest monthly amount, 5.40, occurred at Manti, and the least, 0.10, at Tropic.—*L. H. Murdoch.*

Tennessee.—The mean temperature was 47.8°, or about normal; the highest was 85°, at Madison on the 3d, and the lowest, 8° below zero, at Silverlake on the 8th. The average precipitation was 8.12, or 2.51 above normal; the greatest monthly amount, 17.06, occurred at Benton, and the least, 3.04, at Memphis.—*H. C. Bate.*

Virginia.—The mean temperature was 44.9°, or slightly above normal; the highest was 78°, at Williamsburg on the 11th, and the lowest, 2°, at Monterey on the 7th. The average precipitation was 6.37 or 2.61 above normal; the greatest monthly amount, 11.50, occurred at Bigstone Gap, and the least, 3.47, at Woodstock.—*E. A. Evans.*

Wisconsin.—The mean temperature was 20.1°, or 7.8 below normal; the highest was 60°, at Delavan, Milwaukee, Racine, and Sharon on the 11th; the lowest was 27° below zero, at Butternut on the 1st. The average precipitation was 2.39, or 0.25 above normal; the greatest monthly amount, 5.20, occurred at Spooner, and the least, 0.28, at Beloit.—*W. M. Wilson.*

Wyoming.—The mean temperature was 25.0°, or 3.3 below normal; the highest was 67°, at Fort Laramie on the 8th, and the lowest 23° below zero, at Centennial on the 27th. The average precipitation was 1.86, or 0 33 above normal; the greatest monthly amount, 6.00, occurred at Centennial, and the least, 0.31, at Cody.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

EXPERIMENTS IN WEATHER PREDICTION.

By WM. A. EDDY, Bayonne, N. J.

The kite weather predictions that I have been making at Bayonne, N. J., and which extend back to 1891 (see American Meteorological Journal, July 1891, Vol. VIII, pp. 122–125), deal with a condition of the air at a height of only a few hundred feet. I have left the investigation of greater altitudes to the United States Weather Bureau and the Blue Hill Observatory.

The Weather Bureau forecasts, based on observations at surface stations, have a much greater range and variety and extend over a greater period of time than mine, besides including deductions from a vast organization of stations with studies involving both hemispheres, or the entire circuit of the globe. It is obvious that the Weather Bureau runs a much greater risk than I in many cases; the reason of this, as I believe, is because the conditions forecasted have neither arrived aloft nor at the earth. But the most striking difference between the few predictions which I have made and

the forecasts of the Weather Bureau, is that I have been dealing with conditions that actually exist aloft but not at the earth's surface. The only certainty remaining in my case is that due to the possible failure of those conditions to descend to the earth. I believe that predictions founded on observations taken below the 1,000-foot level will be found to cover a shorter period of time, say twelve hours, than those based on data obtained by means of kites at a height of 10,000 feet, since the Blue Hill observations show that high-level conditions are slower in reaching the earth. The remaining question is as to whether or not changes of wind and the disturbance caused by the sudden formation of anticyclones and cyclones may cause the conditions at the 10,000-foot level to change without affecting the surface air. Owing to my many experiments relating to other questions than weather forecasts I have not had time to properly search out this element of uncertainty, if it exists, in the Blue Hill observations and at Bayonne.

The astonishing fact is beginning to appear that perhaps the most important changes take place within less than 1,000 feet of the earth. In a paper by Mr. A. Lawrence Rotch, Director of Blue Hill Observatory (see Quarterly Journal of the Royal Meteorological Society, Vol. XXIV, No. 108, October, 1898, p. 256) it is said that before a warm wave there is—

During the day a decrease of temperature at the adiabatic rate from the ground up to more than 1,000 feet, then a sudden rise of temperature, amounting perhaps to 15°, followed by a slow fall.

But at the approach of a cold wave he says there is—

A rapid fall of temperature which exceeds the adiabatic rate up to above 1,000 feet, and above that it falls at the adiabatic rate up to 3,000 feet or higher.

Again, he says, p. 257:

After the cold wave has passed and with the coming of a southeast storm the temperature rises rapidly up to a height of 1,000 or 2,000 feet and then slowly falls.

These observations made by Mr. Rotch exactly agree with mine, but I must add the following facts observed recently at Bayonne:

I have found it convenient, instead of using the adiabatic rate of 1° for each 180 feet of ascent to use 1° for every 250 feet of ascent, for the rate of cooling is usually slower for the first thousand feet because of the proximity of the earth, especially in summer. I find that abnormal warmth, at the height of a few hundred feet is apt to precede a cold wave, coming in on the heels of a storm. On one occasion in the autumn the air was 4° warmer than the surface at the height of 300 feet. The steel index on the right-hand side of the (Six's) thermometer could not have been jolted upward. The result was a cold wave the following morning. Meantime, I did not dare to predict. On February 8, 1899, at 8 p. m., when I encountered somewhat similar abnormalities, temperature at the earth rising and falling, but with a rapid fall as the kite-sustained thermometer went upward, I predicted a cold wave for the 9th; the prediction was published in the New York morning Sun of February 9; on the previous afternoon the Weather Bureau had forecasted the same conditions: my local observation was, like all my observations, intended as auxiliary to those of the Weather Bureau. The cold wave lasted a week and broke the record at New York.

Great care is called for in making kite predictions of warm waves founded on warmer air aloft, in case a storm is just passing off; because then the intermingling air currents indicate a cold instead of a warm wave. I think it is necessary in making predictions founded on warmer air aloft, to send the thermometer as far as possible beyond the 1,000-foot level.

At the beginning of a cold wave on February 4, 1891, my kite thermometer recorded a fall of 5° for a height of 600 feet. In the above-mentioned article in the American Meteorological Journal for July, 1891, I said, in discussing this fact:

It was an instance illustrating the fact that a cold wave could be detected promptly through either kite or balloon observations.

While I am preceded in kite thermometer experiments by Wilson and Melville, 1749, in Scotland, and by Birt in Englang in 1847, yet I seem to have been the first to declare in public that the kite could be used for weather prediction and the first to make a positive kite prediction in the public press. I shall continue to experiment regarding some untried problems relative to temperature, snow, hail, sleet, rain, and thunder showers, but in the main I shall turn to other questions while my thermometer ascensions are and will be far surpassed by the wonderful achievements at Blue Hill, Washington, and elsewhere.

OBSERVATIONS AT RIVAS, NICARAGUA.

The records contributed for many years by Dr. Earl Flint, at Rivas, Nicaragua, include barometric readings. His present station is at 11° 26′ N., 85° 47′ W. The observations at 7:17 a. m., local time are simultaneous with Greenwich 1 p. m. The altitude of his barometer is 36 meters above sea level, but until the barometer has been compared with a standard it seems hardly necessary to publish the daily readings. The wind force is recorded on the Beaufort scale, 0–12. When cloudiness is less than $\frac{1}{10}$, the letter "F," or "Few," is recorded.

This station is situated on the western shore of Lake Nicaragua, not far from the eastern end of the western division of the Nicaragua Canal. The volcano Ometepe, on an island in Lake Nicaragua, is about 10 miles northeast of the station. Mr. Flint's records occasionally mention the presence of clouds in the early morning on the summit of this mountain.

Observations at Rivas, Nicaragua, February, 1899.

OBSERVATIONS AT 7:17 A. M. LOCAL (8 A. M. EASTERN STANDARD) TIME.

Date.	Temperature.		Wind.		Upper clouds.			Lower clouds.			Daily rainfall.
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.	
	°	°									
1	76	70	ne.	1	.....	.....	.....	k.	5	ne.	0.00
2	75	71	e.	2–3	.....	.....	.....	k.	1	e.	0.02
3	75.5	70	ne.	2	.....	.....	.....	k.*	Few	ne.	0.00
4	76	70	ne.	2	.....	.....	.....	k.	Few	ne.	0.00
5	76	70	ne.	1	.....	.....	.....	k.	3	ne.	0.00
6	75.5	71	ne.	1	.....	.....	.....	k.	1	ne.	0.00
7	74.5	71	se.	0	.....	.....	.....	k.	5	se.	0.00
8	72	69	sw.	0	.....	.....	.....	ak.	2	nw.	T.
								k.	2	s.w.	
9	74	70	se.	2	cs.	1	.....	ks.	8	se.	0.52
10	74	71	se.	1	.....	.....	.....	k.*	.....	.....	0.00
11	76	72	se.	1	.....	.....	.....	ks.,ak.	2	se.	0.00
12	77	73	se.	1	.....	.....	.....	k.	10	se.	0.33
13	76	70	se.	2–3	cs., ck.	9	se., s.	k.	.....	se.	0.00
14	69	62	se.	3–4	.....	.....	.....	ak.	3	se.	0.00
15	73	67	e.	3	.....	.....	.....	f. k.	2	e.	0.00
16	74	72	se.	0	cs.	5	se.	k.	.....	.....	0.00
17	76	73	se.	1	.....	.....	.....	k.	10	se.	0.69
18	75	72	ne.	1	ck.	Few	nw.	k.	1	ne.	0.02
19	76	71	ne.	2	.....	.....	.....	k.	1	ne.	0.13
20	75	71	ne.	1	ck.	5	se.	k.	1	ne.	0.00
21	77	73	se.	1	.....	.....	.....	k	Few	se.	T.
22	75.5	71	ne.	1	.....	.....	.....	k.*	Few	ne.	0.00
23	76.5	72	ne.	1	.....	.....	.....	k.	1	ne.	0.00
24	77	70	ne.	1	.....	.....	.....	k.	9	ne.	0.00
25	75.5	71	ne.	2	ck.	1	se.	k.	5	se.	0.00
26	76	71	ne.	1	.....	.....	.....	k.	Few	ne.	0.00
27	76.5	72	ne.	1	cs.	.....	sw.	k.	10	ne.	0.00
28	74	68	ne.	2	.....	.....	.....	k.	9	ne.	T.
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.90
Means	75.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*On Ometepe.